CHAPTER 3

IMPLEMENTATION GUIDANCE FOR DESIGN RECONSTITUTION

This guidance is appropriate for high-hazard facilities expected to operate for an extended period. Since DOE facilities vary in hazard level and circumstances of operation, a graded approach to implementation should be adopted.

The implementation guidance is presented in the general sequence in which the design reconstitution (DR) adjunct program is expected to be developed and implemented. Figure 3–1 presents the top-level flowchart for the DR adjunct program.

3.1 PROGRAM PLANS AND PROCEDURES

3.1.1 DESIGN RECONSTITUTION PROGRAM PLAN

The DR program plan should address the topics defined in program criterion 1.3.1.1.c. It should be prepared in accordance with direction set forth by the program management element of the CM program. Although part of the CM program plan, the DR program plan may be provided to DOE separately and should be developed as a stand-alone document.

The DR program plan should identify the scope of the Design Information Summaries (DISs), for both the systems and for design topics, to be prepared. The DR program should prepare DISs for the systems within the CM program scope. To reduce redundancy and ensure consistent application of the topical information, the plan should identify design topics for which a separate topical DIS will be prepared. Potential design topics include seismic qualification, fire protection, environmental protection, electrical separation, single failure, and nuclear criticality.

The DR program plan should provide the method for prioritizing DISs. The priorities of DISs may be based on safety significance, Technical Safety Requirements (TSRs) significance, probabilistic risk assessments, facility modification schedules, impact on other DISs, and the specific needs of the operating and design organizations. Highest priority should be given to those systems addressed by the facility accident analyses or TSRs. The priorities are used to establish the order of DIS preparation.

As part of the description of each DR program activity, the DR program plan should reflect the chosen technical approach and methods for each DR program activity. Descriptions of program activities should demonstrate how the program functions will be accomplished. Within each activity, there are a number of management options that can only be evaluated and selected facility by facility. Examples of these management options are:

- Selection of DIS topical areas
- Detailed methodology for comprehensive search
- Approach to management review to identify the missing basis
- Prioritization methods for regeneration activities
- Scope of regeneration activities
- Approach to the selection of regeneration methods

To clarify the DR program envisioned, program plans should describe selected options. The availability and reliability of existing design information are key in DR program planning. The need for the DR

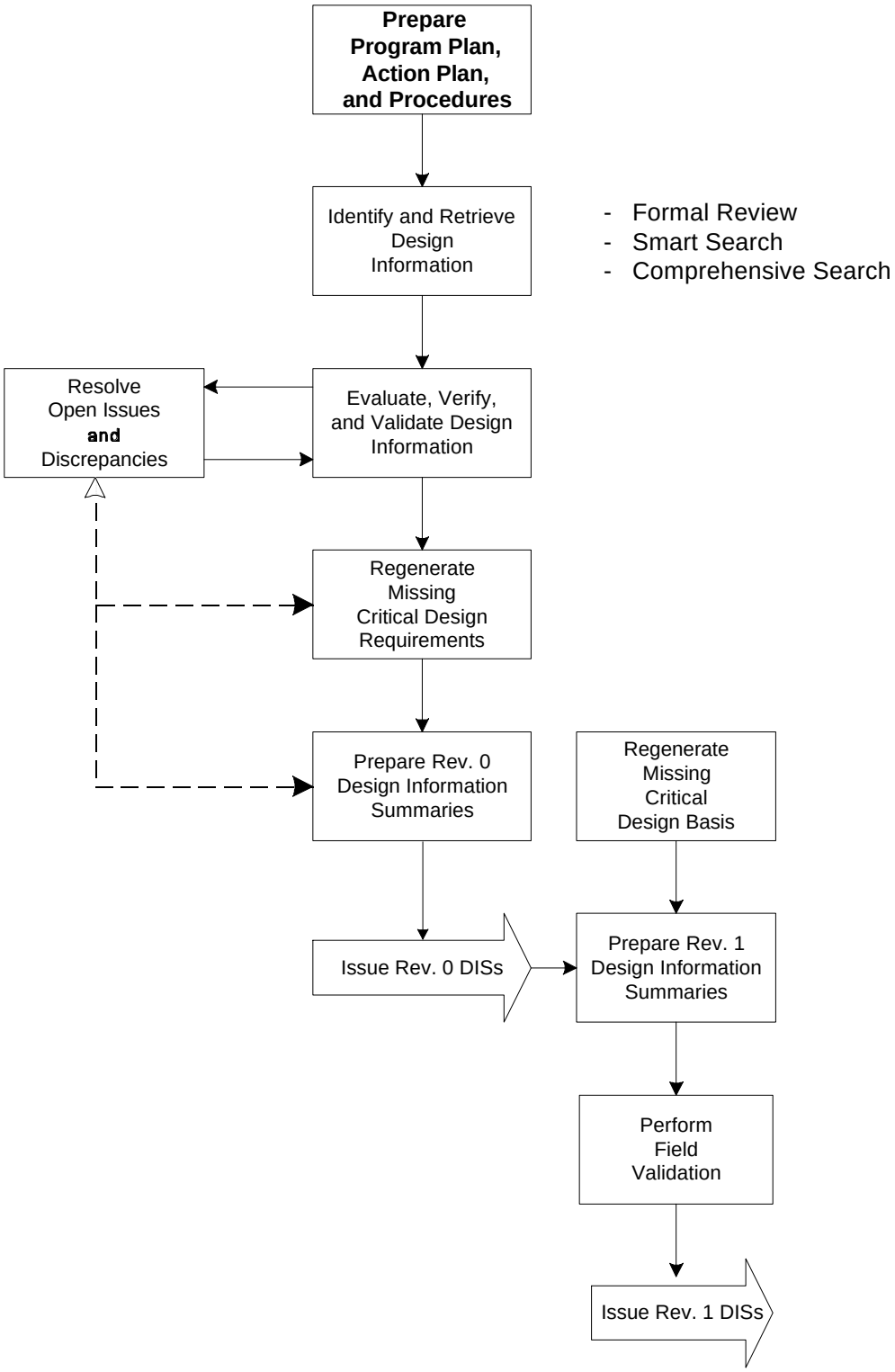


Figure 3-1. Design Reconstitution Program: Implementation Overview

program is based on the completeness, accuracy, and full documentation of existing design information. The DR program plan should present the results and recommendations of the technical management review performed under the design requirements element of the CM program. It should reflect the graded approach and provide the basis for its application. The DR program plan should also reflect the relevant findings of the initial assessments, including:

- Location of design documents
- Availability of design documents
- Control of design documents
- Consistency of information among design documents
- Immediate actions taken and planned

Four examples of different situations regarding the availability and reliability of existing design information are:

- Almost no information readily available
- Moderate amount of information available; some essential information not readily available
- Moderate amount of information available; reliability of information questionable
- Vast amount of information available that is highly trustworthy

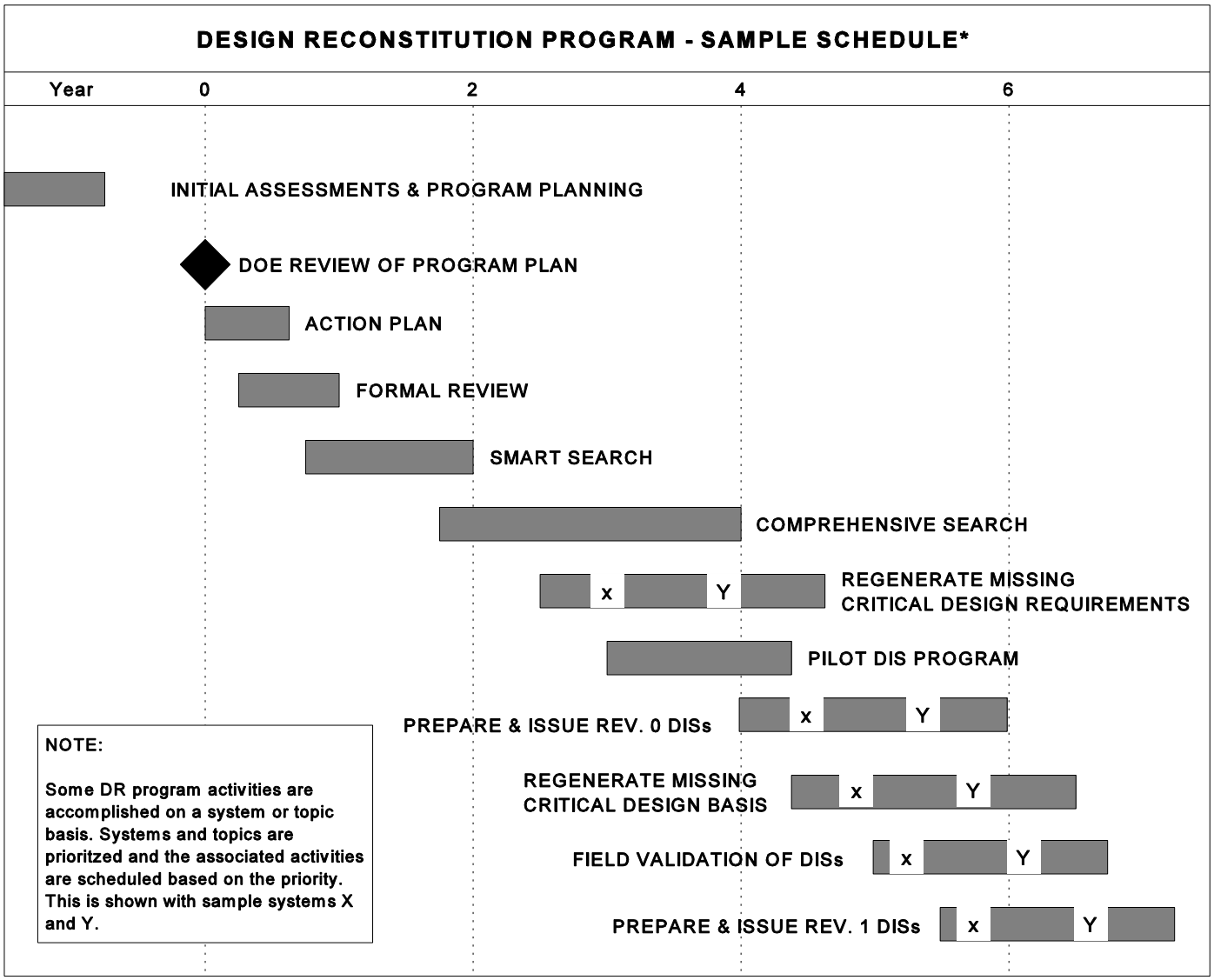
The DR program plan should identify key interfaces with other programs. For example, the Safety Analysis Report (SAR) upgrade program is an important interface to establish. To this end, the DR program would need to include early coordination with the SAR upgrade program to prevent duplication and to ensure the effectiveness of both programs. The program plan should define interfaces with the design requirements program element of the CM program and other CM program elements.

Phased Implementation. The DR program is performed in a phased manner with defined milestones and associated deliverables. A phased approach to design reconstitution provides for an initial set of design information, with further design information added as it is reconstituted. Each activity should be scoped, prioritized, staffed, and funded as appropriate to ensure attainment of the defined milestones.

The program criteria call for the DR program plan to be provided to DOE for review within 6 months after the CM program plan is provided. Thus, the DR program plan may be provided to DOE up to 24 months following the initiation of CM program planning. Design reconstitution program activities should not be implemented before an adequate CM change control element is available. Sample milestones in design reconstitution beginning from the time DOE reviews the DR program plan (see Figure 3–2) are as follows:

- DR action plan (0-6 months)
- Formal review (6-12 months)
- Smart search (1-2 years)
- Comprehensive search (2-4 years)
- regeneration of design requirements (2-5 years)
- Pilot DIS program (2-5 years)
- DIS Revision 0 completion (4-6 years)
- Regeneration of design basis (4-6 years)
- Field validation of DISs (5-7 years)
- DIS Revision 1 completion (5-7 years)

The issuance of completed DISs is also phased by system and topic; as individual DISs are completed, they are issued. The phased preparation and issuance of DISs should be consistent with priorities established by the DR program plan.



*Based on large, complex facility.

Figure 3-2. Design Reconstituion Program: Sample Schedule

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Graded-approach considerations such as facility size and complexity can affect implementation schedules; small, low-complexity facilities could possibly complete a DR program much sooner than the sample milestones shown in Figure 3–2. Facilities that have already completed substantial design reconstitution could also finish sooner than those that have done little or nothing.

3.1.2 DESIGN RECONSTITUTION ACTION PLAN

As described in Section 2.1.4.1, action plans provide additional detail to support program implementation. The DR action plan should identify the program manager and project organization. A clear management mandate and consistent management support are essential to success. Direct involvement by the primary contractor for the facility is also necessary to ensure ownership; knowledge retention; achievement of purpose; and continuing, effective DIS usage. Proper selection of the project team is vital.

The DR action plan should also do the following:

- Identify DIS content and format. Facilities may have somewhat different uses that the DISs will satisfy. A determination of the intended uses of the DISs provides the basis for the format and content of the DISs. Examples of potential DIS applications are provided in Appendix II–D.

- Identify end users, as well as the review and approval process for project deliverables. Early input and feedback from end users is crucial to the usefulness and use of DISs.

- Describe the DR governing and implementing procedures to be prepared. Such procedures establish management control over the processes for developing, reviewing, and approving DISs, and define and communicate the appropriate standards.

- Address programmatic controls and procedures for implementation of applicable portions of the site/facility quality assurance (QA) plan.

- Identify periodic assessments of DR program activities. Throughout program implementation, it is important to maintain a broad perspective and a questioning attitude regarding assumptions and the use of information from reference documents, as well as the relationships and use of information from resource documents. Periodic assessments can supplement training and supervision in ensuring that a questioning attitude is maintained.

The DR action plan should be revised and updated as the program proceeds. Initially, the plan should provide the greatest detail on the earlier activities -- the design information retrieval activities.

3.1.3 DESIGN RECONSTITUTION PROGRAM GOVERNING AND IMPLEMENTING PROCEDURES

As an outgrowth of the DR action plan, an overall DR program governing procedure should be prepared to provide coordination and integration of the various implementation procedures and implementing organizations. The governing procedure should indicate how the DR program functions are carried out in the various implementing procedures and, thus, how they conform with the DR program plan. Governing procedures in the form of functional flowcharts are helpful in identifying procedural gaps and conflicts between specific implementing procedures.

In contrast with governing procedures, the DR implementing procedures provide detailed instructions for carrying out DR program functions. Development of DR implementing procedures to control technical methods and interfaces should be completed before each activity begins. These procedures should

ensure a consistent approach from source document identification through DIS issuance. They should address and control responsibilities associated with document preparation, review and approval processes, and the long-term maintenance and control of completed documents. They should address the activities necessary to implement the DR program, including the following:

- Personnel selection, orientation, and training
- Project interfaces (organizational and programmatic)
- Project control (schedule and milestones control)
- Identification of potential source documents
- Technical review of source documents
- Verification and technical validation
- Discrepancy resolution and open-item management
- DIS development (including format and content guide, and layout guide)
- DIS review and approval
- DIS field validation
- DIS maintenance and revision

3.2 IDENTIFICATION AND RETRIEVAL OF DESIGN INFORMATION

Identification and retrieval of design information are divisible into two distinct subfunctions: (1) identification and retrieval of the source document that might contain design information and (2) extraction of the design information contained in the identified source documents Each of these subfunctions calls for unique experience and expertise. Identification and retrieval of source documents involves identifying the document types and specific documents that contain design information, locating the documents, and retrieving and cataloging the documents. Extraction of design information presupposes technical expertise in recognizing and classifying various types of such information.

Identification and retrieval of design information is accomplished through three phased activities: formal review, smart search, and comprehensive search. These phases correlate with increasing design detail: the formal review concentrates on summary-level design documents; the smart search, the outputs of the design process; and the comprehensive search, the remaining relevant source documents, particularly those establishing the design basis for the design requirements. These phases differ primarily in scope. During each phase, after the source documents are identified and retrieved, the source documents are reviewed to extract the relevant design information, both design requirements and design basis. The approach to design information extraction should be essentially the same, regardless of the source document. The cumulative result of these activities at any stage constitutes the Best Available Design Information.

Facilities should identify pilot DR activities to gain experience and to solidify methods. For example, a selected file room could be reviewed initially to identify and retrieve source documents. Then, this effort could be critiqued to improve the methods used before going on and applying the approach to other document locations. Similarly, pilot extraction efforts on selected documents could be useful in refining extraction methods and procedures. Appropriate implementation procedures could be prepared and then tested by pilots to control each activity. Further, where adequate design information is not available, individual facilities may also identify supplementary activities for design reconstitution. For example, facility walkdowns to gather nameplate data could be undertaken, if necessary and beneficial.

Concurrent with DR efforts, the normal design process continues to generate new and revised design requirements and the design basis. These normal design activities also contribute to the Best Available Design Information. Controls should be in place to ensure that ongoing design process efforts and DR

efforts are coordinated. For major design changes, it might prove necessary to accelerate the design reconstitution of associated systems and components.

3.2.1 IDENTIFICATION AND RETRIEVAL OF SOURCE DOCUMENTS

Throughout these searches, the document control organization should provide support in locating and retrieving the subject documents. If possible, these search activities should be coordinated with document control activities that identify that organization's design and configuration documents. Documents identified during the searches should be reviewed for inclusion into document control processes and systems, such as the CM document database. A comprehensive index of design documents is a very useful tool until design reconstitution is completed. Figure 3–3 shows the key steps of source document identification and retrieval.

3.2.1.1 Formal Review

The formal review of on-hand, summary-level design documents is the first stage of identification and retrieval of existing design information. The scope for this review should be limited to readily available, top-level design documents such as SARs, Technical Safety Requirements, and System Design Descriptions (SDDs), if available, and other top-level synthesis and summary-type design documents.

Through document identification and information extraction, the formal review establishes the preliminary set of design requirements and the design basis. For facilities with inadequate design requirements (as determined by the CM program initial assessments or otherwise), the formal review may be needed to support initial development of certain portions of the DR program element (i.e., establishment of the CM equipment database, initial system categorization, and initial system grading) and may be pursued as a priority action within CM program implementation.

3.2.1.2 Smart Search

The smart search identifies and retrieves those types of documents most likely to contain design requirements. It culminates in the identification of most of the retrievable design requirements as well as the design basis information contained in the associated source documents. The smart search provides an expedited input to the CM equipment database for use by design and other facility personnel. The documents that are most likely to contain design requirements are the design output documents. These documents include drawings, specifications, load lists, valve lists, operational setpoints, maintenance and test requirements, and construction and installation instructions. Further examples of design output documents are provided in Appendix II–B.

Experienced personnel can provide insight into the most likely document types and their locations. Experienced facility personnel might know of facility-specific documents that are not design output documents but are likely to contain design requirements; the smart search should target these documents. While certain design analyses and calculations might contain design requirements, such documents should generally be reviewed during the comprehensive search, which focuses on source documents containing primarily design basis information.

To capture the facility design requirements, the smart search scope may have to include facility documentation that reflects the as-built design. Original design documents are preferred over reconstituted as-built documents but are not always available. Sometimes these reconstituted as-built documents use nameplate rating as the design requirement, lacking better information. This approach presumes that the design is competent and the nameplate rating meets or exceeds the requirements determined by the original design. In most cases, the structures, systems, and components (SSCs) can continue to meet their nameplate ratings and detailed analysis of the original design requirement is

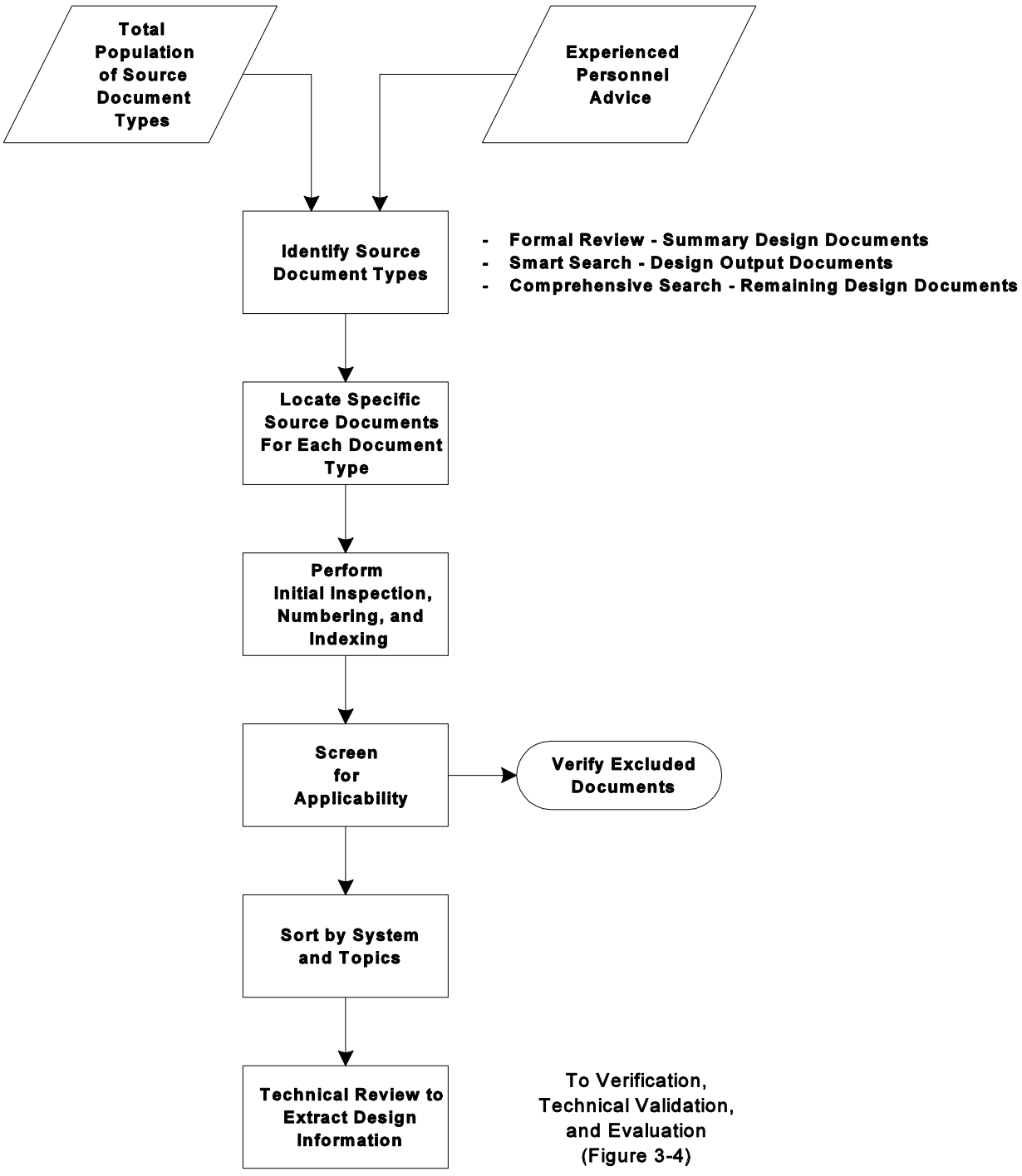

Figure 3-3. Design Reconstitution Program: Design Information Identification and Retrieval

not necessary. If, however, a test indicated a component (e.g., a pump) could no longer meet its nameplate rating, the design engineering organization would reevaluate the design requirement.

Document types may be identified before they are located, as indicated in Figure 3–3. They may also be uncovered by surveying files at storage locations known to contain design documents. The locations can range from vendor files and warehouse storage to individual design engineer files. Many original design documents may be stored in warehouses or other files and not be easy to retrieve.

To facilitate document review, it is useful to (1) assign each document a unique identifier to facilitate control and tracking and (2) perform an initial or receipt inspection to ensure that the documents are readable and complete. If the documents are not already indexed as to technical content, facilities should consider indexing them. A document review matrix may be helpful in determining, (I) which document types do not need to be reviewed for design information, (2) which document types should be reviewed, and (3) which document types are expected to contain such information. Each potential source document should be screened to determine if it contains design information and if technical review is necessary to extract that information. Documents related to past missions and past configurations that are no longer valid should be excluded at this point, as should documents related to SSCs that are not included in the CM program. Other specific documents that do not actually provide design information should also be excluded. A second-party review should be conducted to verify that the exclusion of specific documents or document types from further review was warranted.

The collected source documents that contain design information should be organized or sorted by system or topical area such that they are readily retrievable for future review needs. Documents thus sorted can be easily directed to the best technical reviewer for the extraction of design information. Sorting may be difficult, as some documents involve many systems and topics.

3.2.1.3 Comprehensive Search

The comprehensive search aims at identifying and retrieving the remaining documents that might contain design information, including design analyses and calculations, DOE correspondence, and vendor correspondence. This search identifies mostly design-basis information, but it may serve to capture additional design requirements.

Care should be taken not to limit the extent of the comprehensive search, for its success depends primarily on the identification and location of all source documents containing design information. The comprehensive search team should interview and interact with experienced engineering and operations personnel to locate and collect information, including information stored in desks and personal files. Moreover, they should investigate referenced design documents for potential design basis information. A design output document identified and reviewed in the smart search might contain references to various documents used as the basis for the design requirements it defines; these are good targets for the comprehensive search.

Source document types likely to contain design basis information include DOE correspondence, design agency correspondence, vendor correspondence, internal correspondence, meeting minutes, engineering procedures, engineering calculations and analyses, engineering studies and reports, code conformance evaluations, and engineering forms and documentation used to implement designs and design changes. Further examples of design documents are provided in Appendix II–B. In addition to reviewing engineering records, the team should review correspondence files or indexes to identify relevant source documents. Document types that might not need review include press releases, financial reports, and indemnity agreements.

Although they differ in scope, the comprehensive and smart searches should be essentially the same in terms of their methods of document identification and retrieval (see Figure 3–3). Of course, the methodology for document screening, labeling, and sorting developed for the smart search may be refined for the comprehensive search on the basis of lessons learned.

3.2.2 EXTRACTION OF DESIGN INFORMATION

After the source documents are identified, retrieved, cataloged, and sorted, they are reviewed to extract the design information they contain. The documents should be directed to the technical reviewers who have expertise in the systems and disciplines reviewed. If documents are sorted incorrectly, the technical reviewer should relabel them and direct them to the appropriate reviewer. The technical reviewer should handle each assigned document only once, for this Is the most efficient and effective approach to extracting design information. For each document reviewed, the technical reviewer identifies and differentiates design requirements and design basis Information. Extracted design information is also identified as to the applicable facility SSCs, types of SSCs, and technical topic area.

Categorizing design requirements by type may also be performed efficiently during the technical extraction process. Differentiating the various design requirement types should be easiest during the review of source documents. Often, source documents merely state design attributes that are not requirements of the design process; that is, they are not safety, environmental, or mission design requirements. Incorrectly classifying these design attributes as primary design requirement types can impose undue constraints on engineering activities in connection with design changes or other evaluations.

Different methods of extracting the design requirements and design basis information are acceptable. The reviewer may enter the information directly into a holding database, computer or otherwise, for storage prior to verification and technical validation. Alternatively, the reviewer may highlight the information for a clerk to enter into a holding database. The former approach allows for some summarizing or paraphrasing of design document words to capture their intent exactly, but it involves more of the reviewer's time. Whichever method is chosen, to ensure its effectiveness, the appropriate procedures and training should be provided.

The following actions promote the successful extraction of design information:

- Select a small, dedicated group of personnel.
- Select personnel with facility experience and familiarity.
- Provide clear written procedures.
- Provide thorough training.
- Provide a standard list of SSCs.
- Provide standard definitions of design basis and design requirements.
- Provide extensive examples of design basis and design requirements.
- Provide standard definitions and examples to differentiate design requirement types.
- Use checklists.
- Maintain focus on the format and contents of the final products.
- Maintain strong controls on DR information databases.

3.3 EVALUATION, VERIFICATION, AND VALIDATION OF DESIGN INFORMATION

The objective of the evaluation function is to determine whether retrieved design information is accurate and complete. This function includes verification of the extraction process; technical validation of the

extracted design information; and technical management review, which includes the identification of any missing design information. A flowchart of these activities is presented as Figure 3–4.

3.3.1 VERIFICATION OF DESIGN INFORMATION

The design information extracted during each identification and retrieval phase (i.e., formal review, smart search, and comprehensive search) should be verified. Proper verification entails checks to ensure that the extracted information is accurate and that no design information was overlooked. Verification should be performed by someone other than the individual who extracted the design information from the source document. It may be performed more efficiently by reviewing the source document along with the extracted design information. Independent extraction and comparison of results are not necessary. Verification should be performed shortly after each source document is technically reviewed to extract design information. Verification can reveal discrete errors and omissions and provide feedback conducive to improvement of extraction methods and personnel performance.

3.3.2 TECHNICAL VALIDATION OF DESIGN INFORMATION

Technical validation differs from verification performed earlier; it is an independent technical review that exceeds the quality check accomplished by verification. Technical validation ensures that the retrieved information is technically appropriate and correct; this includes the assumptions on which such information is based and the methods by which it was produced. On a sample basis, consideration should be given to whether the design information is appropriate for the current design arid physical configuration.

Critical calculations and analyses should be validated by performing them independently and by different methods. Priority should be given to equipment that supports accident prevention and mitigation and to those design documents for which the accuracy of the original calculations and analyses is suspect.

Technical information developed before formal QA requirements were established may be considered valid if it is labeled, legible, logical, and pertinent to the current physical configuration. Any open items or discrepancies should be identified for evaluation through the DR program discrepancy resolution process.

Technical validation should be performed by technically competent individuals familiar with the facility design and the design process. The same individuals involved in extraction and verification may perform the technical validation; however, the validation activity should be clearly separated from the extraction and verification activities.

Unlike verification activities, technical validation is most efficiently performed on small batches of system-specific or topical design information rather than on source documents as a whole. Validation should take place at regular intervals (e.g., once a month or once a quarter) or after a defined set of documents have been reviewed. The benefits of validating information in batches are that efficiency is gained by validating many pieces of design information together on a single system or topic and that effectiveness of the validation can be improved by the insights gathered from accompanying information. On the other hand, as technical validation is the last step before release of extracted design information, it should be scheduled so as to provide for the timely release of results.

3.3.3 RELEASE OF VERIFIED AND VALIDATED DESIGN INFORMATION

After the design information is technically validated, it should be added to the CM equipment database for use in supporting ongoing design and operations activities. This step is crucial to making the results

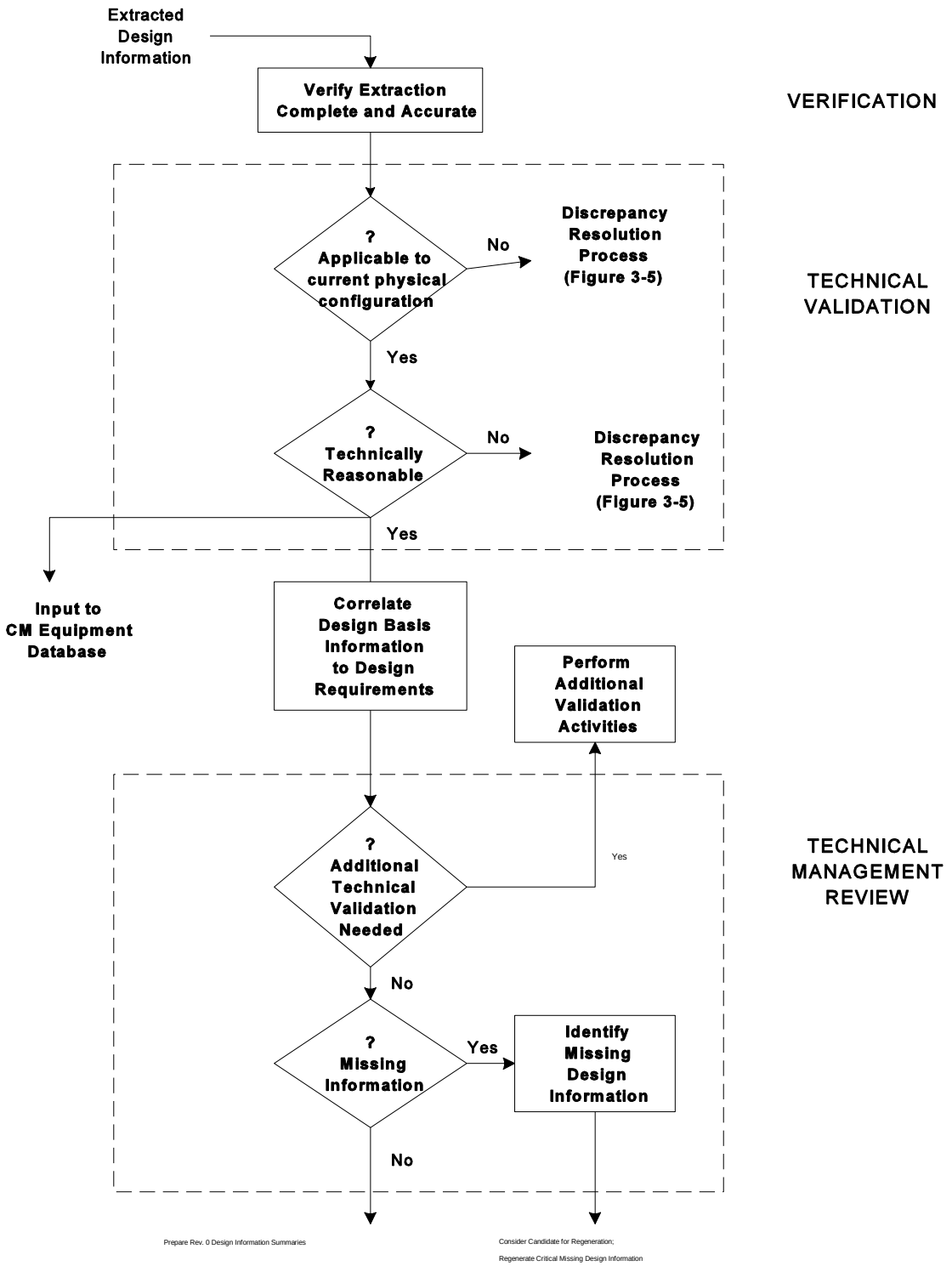

Figure 3-4. Design Reconstitution Program: Evaluation of Extracted Design Information

of the DR program available for use, as it occurs long before the preparation and issuance of DISs. Adding only validated design information to the CM equipment database ensures that the database remains a credible source of design information. Timely release of the extracted design information depends on the timely verification and validation thereof.

The verified and validated design requirements should be reviewed for impact on system and component grading when entering them into the CM equipment database. As information is entered into the database, ft may be found that different pieces of validated information are in conflict. If so, an open item or discrepancy should be identified for evaluation through the DR program discrepancy resolution process. Until the Item is resolved, the associated data entries should be removed from the CM equipment database because their validity is in question.

Reconstituted design requirements should be released and forwarded through the established change control and document control processes exactly as they would be if they were new requirements. This is necessary to ensure that the physical configuration and, particularly, the facility documentation accurately reflect these requirements. One approach would be to group reconstituted design requirements by system at various stages of reconstitution and provide them to other organizations so that they could make necessary changes in configuration documents under their control. Treating the issuance of reconstituted design requirements with controls similar to those for new designs should instill the necessary discipline into the information release process. Each affected organization would acknowledge receipt of the reconstituted design requirements and the incorporation thereof into their documents. Any open items would be identified and resolved at that time. Similarly, open items identified in walkdowns or record searches would be reconciled with the design requirements. In this manner, the reconstituted design requirements would be reconciled with the physical configuration and the facility documents long before the DIS field validation, which is the final check.

Design basis information need not be released in this manner, however, because the physical configuration and facility documents reflect the design requirements, not the design basis. Validated design basis information should be released and reviewed within the design authority and supporting design organizations to ensure that design documents are consistent.

3.3.4 CORRELATION OF DESIGN BASIS TO DESIGN REQUIREMENTS

The validated design basis information is examined against the facility design requirements to establish a one-for-one correlation and to expose any incompleteness in the retrieved requirements and basis. Where the design basis is incomplete or nonexistent, the missing information should be noted. The CM equipment database, which relates the facility SSCs and design requirements, should be used to support this correlation.

3.3.5 TECHNICAL MANAGEMENT REVIEW OF DESIGN INFORMATION

After technical validation and correlation, a technical management review similar to that conducted initially in the design requirements element should be used to evaluate both completeness and validity of the extracted design information. The review should independently assess the previous technical validation efforts and determine whether additional technical validation activities are needed. It should also determine whether any design information is missing and identify the missing design information. Missing and inaccurate design information will be candidates for regeneration.

The need for additional, detailed technical validation is to be expected for critical design information. In determining whether further technical validation is needed, the following should be considered: the status of the original design and construction documents, their importance to facility safety and mission, the extent or frequency of post-construction changes, the effectiveness of the facility modification

control program, the number and nature of reportable events, and deficiencies and conflicts uncovered in using design documents.

Completeness reviews should be conducted by system or topic. For each system or topic, the full set of extracted, verified, and validated design requirements or design basis should be collected and evaluated as a unit. Evaluation of these sets of information is a direct precursor to DIS preparation. Several different approaches are possible for determining the completeness of design information, as described in Section 2.2.1.3. The technical management review is the recommended approach to completing evaluation of the extracted information because of the breadth and depth of experience that can be applied and because of the independence of the review from the initial extraction, verification, and technical validation. The review process should be procedurally established, taking into consideration any lessons learned from the initial technical management review employed for the CM program design requirements element.

The technical management review of design requirements may begin upon the completion of the smart search, which concentrates on the source documents most likely to contain design requirements, and may proceed in parallel with the comprehensive search, which focuses on documents containing design basis information and, thus, is not expected to yield many new design requirements. This review is conducted before the design basis review so that the initial DISs can be issued and candidate design requirements for regeneration can be determined as promptly as possible. Technical management review of design basis information should be initiated following completion of the comprehensive search. The processes for the design requirements and design basis reviews should be essentially the same, even though the reviews can occur at different times.

Following the management review and completion and approval of any additional actions,, the design information is ready for formatting and initial DIS issuance. The final validation activity, field validation, occurs following the regeneration of critical missing design information and the preparation of DISs.

3.4 RESOLUTION OF DISCREPANCIES

The program criteria establish that a formal discrepancy resolution process should be defined and used to support the DR program. The discrepancy resolution process interfaces with existing facility programs, as indicated in Figure 3–5. Open items should be identified to expose unanswered technical questions, concerns, and cases of missing or inaccurate information. Open items will arise from documentation conflicts; undocumented verifications and validations; and undocumented design inputs, constraints, calculations, and analyses. The validity of items should be confirmed; if an open item is not valid, it should be closed.

Open items may be identified at any point in the design reconstitution process, from information retrieval to field validation. Strong interaction is to be expected between the design information evaluation function (i.e., verification, validation, and technical management review) and the discrepancy resolution function, because the evaluation function concentrates on the accuracy and completeness of the extracted design information.

Open items with safety significance should be identified as discrepancies. Preliminary safety--significance screening of discrepancies includes an assessment of TSR, SAR, and DOE commitment impacts. If any such impacts are identified, the discrepancy should be evaluated for operability and reportability impacts. Safety-significant discrepancies are to be promptly transferred to existing problem resolution programs, such as those for nonconformance reporting, to determine if any immediate action is necessary. Existing programs are appropriate for operability and reportability reviews because they are specifically designed to accommodate such reviews and they command the necessary experience

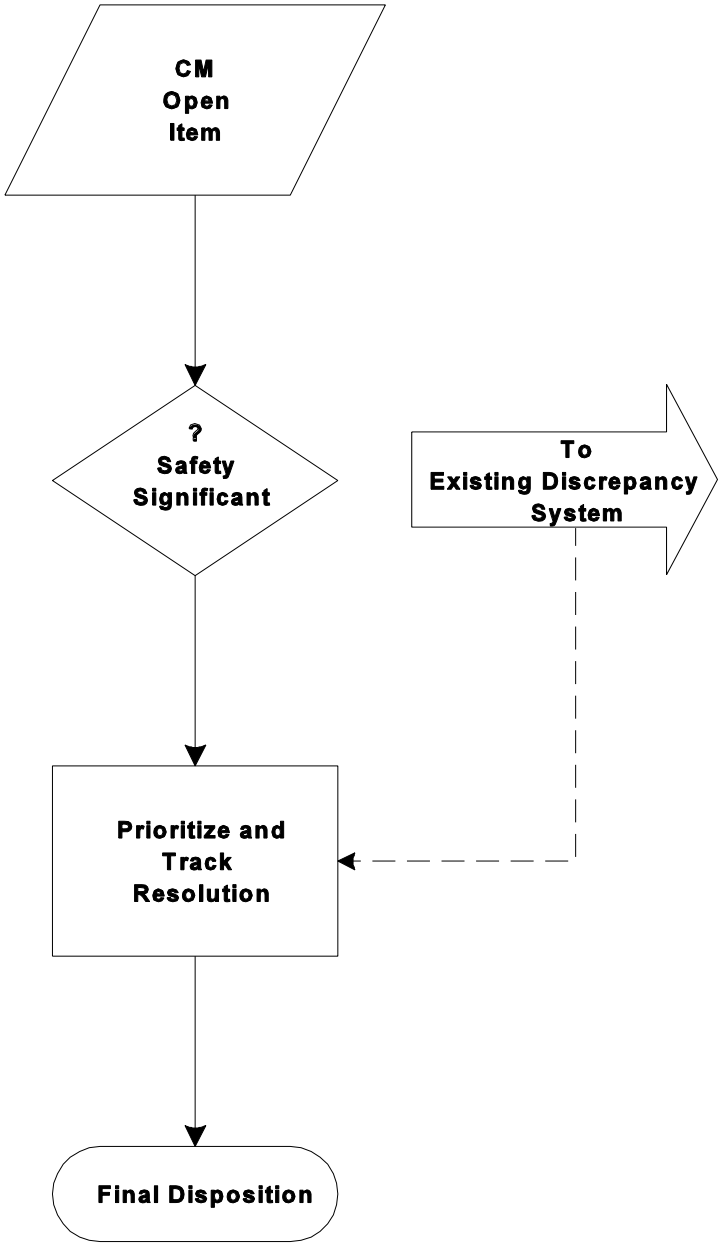

Figure 3-5. Design Reconstitution Program: Discrepancy Resolution Process

and expertise. Operability and reportability reviews should be performed according to standard procedures.

Underlying all DR program activities is the presumption of system and component operability unless, and until, there is confirmed information to the contrary. The presumption of operability is reasonable where broad engineering experience and judgment indicate that an affected system or component is functional, even if sufficient information is not available to make and fully document the final decision on a particular discrepancy. Under the presumption of operability, the information necessary to make a clear determination should be obtained or developed expeditiously and should be acted on thereafter. This approach satisfies the need to operate facilities conservatively by limiting the potential for unnecessary challenges to facility safety systems and personnel. The presumption of operability is not intended as a means of deferring actions necessary to address discrepancies; if a discrepancy clearly affects the safety of facility operation, action to place the facility In a safe condition has to be taken.

Each open item is evaluated and disposed of within the DR program in a manner that supports the program deliverables and schedule. The order of resolution should be based on importance and potential impact. The discrepancy resolution program should track each open item and discrepancy through to completion and closeout. Resolution of open items and discrepancies includes documenting the final disposition. Items directed to existing issue management programs should be tracked to ensure that resolution is complete.

3.5 REGENERATION OF MISSING CRITICAL DESIGN INFORMATION

The technical management review determines what design information is missing and which items of missing information will be regenerated. Missing information that is critical to design or operation should be regenerated. The order of regeneration activities should be based on their importance.

Regeneration of the design requirements should begin before regeneration of the design basis to provide a complete and accurate set of design requirements as promptly as possible. Regeneration of design requirements is a high priority because the physical configuration is established by, and should be consistent with, the requirements. The processes for design requirements and design basis regeneration should be similar.

Regeneration of design requirements may begin after the evaluation of design requirements and proceed in parallel with the completion of the comprehensive search. Regeneration of design basis information should be initiated after the comprehensive search and the evaluation of design basis information to identify missing information. Design basis regeneration is not needed for initial DIS issuance, but it may occur in parallel with the preparation of the initial DISs.

3.5.1 REGENERATION OF DESIGN REQUIREMENTS

The missing design requirements may include requirements of each type (e.g., safety, environmental, mission) for SSCs of each grade (e.g., safety, environmental, mission). If missing design requirements were fully regenerated, each type of requirement for each grade of SSC would be regenerated. Full regeneration of design requirements may be appropriate for the most important grades of SSCs (such as safety and environmental), but not for every SSC.

Facilities should consider the missing design requirements for a given system or topic, determine which requirements are critical, and prioritize the associated regeneration activities. Regeneration of design requirements for SSCs that support the accident analyses or TSRs should receive highest priority.

Second priority should be given to those design requirements necessary for facility operations, such as set point data.

Two options exist for prioritization of remaining regeneration activities: (1) prioritize by requirement type-safety requirements, followed by environmental requirements, and so on; or (2) prioritize by grade (importance) of the SSCs involved. If option 2 is indicated, missing design requirements of every type would be regenerated first for the most important SSCs (i.e., safety and then environmental SSCs). Other possible bases for prioritization include modification history, future plans for modification, and design pedigree.

Several methods have proven successful for reestablishing missing design requirements:

- Performing reanalysis. This approach is basically equivalent to redesign; it applies the design process to determine design requirements. Although the most technically acceptable method for regenerating missing requirements, it is typically the most expensive. This approach should be used for the most important missing design requirements.

- Gathering and documenting information from the experience of knowledgeable engineering and operations personnel. Their memory is a valuable (and frequently undocumented) source of information, and that information could be lost through attrition, transfers, retirement and death. This activity should start promptly to prevent any further loss of knowledge.

- Reenacting the original design process to decide which design outputs or portions of the equipment specifications are essential and which are optional. A combination of the first two approaches, this method may not go as far as reanalysis, but does carefully consider the likely design inputs, constraints, analysis and calculations, and outputs. After reanalysis, this is the most technically acceptable method.

- Testing equipment to determine its current functionality and accepting the results as design requirements after a technical evaluation by the engineering organization. Testing might be the only practical method for showing that system performance remains adequate.

Reenacting the original design process calls for envisioning that original process. Hypothetically, after having established the fundamentals of the system design, the designer could discuss options with various component vendors. At the beginning of such a discussion, the designer might explain the general application and the functional requirements for the system. Attention would focus on a particular component, such as a valve, and the designer would explain what the valve needed to be able to do. For example, during normal facility operation, the valve has to remain closed to provide intersystem isolation with minimum leakage. During accident conditions, the valve has to stroke open against a differential pressure as high as 500 psid and be fully open within 10 seconds. For failure considerations, the valve has to fail in its as-is position. In response, the vendor might suggest a certain valve for the application. Through an iterative process, the designer and vendor would arrive at the final selection. Recreating this type of hypothetical discussion and capturing the pertinent points is part of reenacting the original design process.

The selection of regeneration method is based on available information, the importance of the SSCs, feasibility, and resources. A combination of methods is often a cost-effective approach.

Throughout design requirements regeneration, the design basis resulting from the regeneration efforts should be documented. After regeneration, a management review should be conducted to approve the completed set of requirements. As with the other stages, the regenerated design requirements feed to the CM equipment database and might affect system and component grading. Design requirements

regeneration completes the reconstitution of the existing design requirements. Where certain design requirements are not regenerated, the missing design requirements should be noted for listing in the DIS.

3.5.2 REGENERATION OF DESIGN BASIS

The technical management review will also identify missing design basis that are candidates for regeneration. Similar to the review of missing design requirements, facilities should consider the missing design basis for a given system or topic, determine which are critical, and prioritize the associated regeneration activities. Regeneration is not needed for all missing design basis. The DR program should establish the priority and the time frame for regeneration activities. Highest priority should be given to regeneration of the design basis for SSCs that support the accident analyses or TSRs. Further prioritization may be based on the following factors: associated design requirement type (e.g., safety, environmental), associated SSC importance, modification history, future plans for modification, and design pedigree.

The basic methods of regeneration (reanalysis, documented experience, reenactment, and testing) of design requirements apply also to the design basis. After regeneration of design requirements, a management review should be conducted to approve the completed set of design basis information.

3.6 PREPARATION AND ISSUANCE OF DESIGN INFORMATION SUMMARIES

The DR program results in complete, verified, and validated DISs. The specific scope of system and topical DISs to be prepared is defined by the DR program plan.

3.6.1 PILOT DESIGN INFORMATION SUMMARY PROGRAM

A pilot DIS program should be performed before proceeding with the full-scale DIS program. This allows for testing the adequacy of program procedures to ensure the development of consistent products and the satisfaction of program goals and objectives before the start of full-scale DIS production and further expenditure of resources. This pilot effort should focus on DIS preparation and review, including DIS format, contents, and layout.

The pilot DIS program should include both system-level DISs and a topical DIS. One of the system DISs should be for a safety system. The DISs prepared during the pilot program may be used as a starting point or as-is for the associated Revision 0 DISs prepared in the full-scale DIS program.

The DIS pilot program may begin before completion of the retrieval of available design basis information (i.e., before completion of the comprehensive search) and before completion of the design requirements regeneration. For the pilot program, the completeness of design information is not as important as the process and its effectiveness. At the conclusion of the pilot program, lessons learned should be identified and incorporated into the DR action plan and procedures.

3.6.2 DESIGN INFORMATION SUMMARY FORMAT AND CONTENT GUIDE

The contents, format, and style of the DISs will have a great impact on their usefulness and, therefore, their cost-effectiveness. To ensure that the DISs meet their intent, DIS preparation guidance should be provided for writers and reviewers. The DIS Format and Content Guide should specify DIS contents and explain what is to be included in each section.

As defined in the program criteria, DISs should include the following information:

- System description (including system interface information)
- System operability requirements
- System-level design requirements
- Component-level design requirements
- Design basis
- Related design topical information

The DIS Format and Content Guide should define the level of detail of the technical content. It should also define the general format and approach and should include guidance on technical writing and style. Further guidance on DIS format and content is provided in Appendix II–D.

Design Information Summaries should be written for a variety of users and experience levels. The DR action plan should have identified the end users and end uses. Users will range from operations, maintenance, testing, procurement, training, and QA personnel to design engineers. Design information Summaries should be tailored to meet individual facility needs and constraints, making use of existing programs and results. The level of detail should reflect program objectives and end uses.

To avoid reliance on current experience levels, DISs should be written for a hypothetical 3–year engineer. Such an engineer (or scientist) would have a general facility background, would know the facility layout, and would know the general actions the system has to perform. This approach defines an appropriate DIS content without getting into unnecessary details and explanations.

For DISs, a mixed approach is preferable to comprehensive or index approaches. The index approach involves minimal text and extensive lists of references. This approach collates the design information and provides a road map for a prospective user. The comprehensive approach involves text material and copies of actual design documents such as procurement specifications, with a minimum of references. The mixed approach is a balance between the index approach and the comprehensive approach and provides the most useful and cost-effective DISs.

The mixed approach makes significant use of text material but references key supporting design process documents. The text includes system descriptions and drawings, operability requirements, system functions, component information, system and component design basis, regulatory requirements, and DOE commitments. Referenced documents include calculations and analyses, codes and standards, design practices, procurement specifications, and TSRs. It is unnecessary to duplicate the content of other self-contained documents such as American Society of Mechanical Engineers (ASME) code stress reports, equipment qualification data packages, vendor manuals, operations and maintenance procedures, industry codes and standards, specifications, generic regulatory requirements, and calculations.

References should be to design process documents (e.g., calculations, analyses) rather than facility operating and maintenance documents or secondary facility configuration documentation. The original information should be referenced whenever possible to avoid translation and interpretation errors.

3.6.3 DESIGN INFORMATION SUMMARY LAYOUT GUIDE

A DIS Layout Guide, separate from the DIS Format and Content Guide, should be prepared to ensure consistency in document layout and word processing conventions. Such a guide would contain instructions on margins, spacing, numbering, and other issues of particular benefit to DIS word processors and editors. The DIS Layout Guide should clearly distinguish between design requirements

and the design basis, the authorization basis and other design basis information, and the various types of design requirements.

3.6.4 DESIGN INFORMATION SUMMARY USERS' GUIDE

Facilities also should prepare a DIS Users' Guide. In addition to a discussion of DIS format and content, the guide would contain background on the design process, definitions of key terms, a discussion of DIS development and intended uses, descriptions of methods for reporting erroneous or discrepant DIS information and methods for modifying and updating design requirements and basis, and additional references. As appropriate, the DIS Users' Guide would provide guidance on other sources of design information (which might be referenced by the DISs); on how and where such information is stored, and how to access and use it; and on the limitations of its use. The DIS Users' Guide would provide for the most effective use of the DISs produced.

3.6.5 FINAL VERIFICATION OF DESIGN INFORMATION SUMMARIES

A final check should be made to verify that the information contained in each DIS has been accurately translated and transcribed during the DIS preparation process. This verification should ensure that any remaining open items are identified correctly and completely. Verification checklists should be used to promote consistency, identify areas for review, provide stimuli for additional questions, and document the verification. Independent reviewers should have sufficient technical background and experience to provide an objective, credible verfification of the DIS information.

3.6.6 ISSUANCE OF DESIGN INFORMATION SUMMARIES

Design Information Summaries are issued in at least two major stages: the initial issuance (Revision 0) and the first major revision (Revision 1). It is recognized that Revision 0 may be updated or revised before Revision 1 is issued. Revision 0 contains the complete, accurate, and technically validated design requirements, original and regenerated. It also includes the available, technically validated design basis information, correlated with the design requirements. Any open items are identified. Issuance of DIS Revision 0 provides for the early availability of quality design information. After the remaining DR program activities are completed, the DIS is revised (Revision 1) to incorporate the regenerated design basis and the results of the field validation. Issuance of Revision I culminates the DR program.

The technical management review of extracted, verified, technically validated design information may be performed effectively using draft Revision 0. Design information in the DIS format may be best suited to review for technical validity and evaluation for completeness.

Design Information Summaries should be issued as controlled documents in accordance with the document control program. Review and approval of the DISs, Revisions 0 and 1, should include interdisciplinary review within the design engineering organization, as well as appropriate interdepartmental review-by operations, maintenance, systems engineering, and other affected organizations. These DIS reviews should establish that the DIS information is correct and that the organization's documents are consistent with the DIS.

3.6.7 FIELD VALIDATION OF DESIGN INFORMATION SUMMARIES

Field validation is completed before the issuance of DIS Revision 1. Field validation ensures that design requirements are properly reflected in the physical configuration and in the associated documentation. It also tests the strength of the bonds in the basic CM program model (i.e., among design requirements, the physical configuration, and the configuration documentation). Design basis information cannot be field-validated because its physical configuration and its documentation reflect

the design requirements, not the basis for the requirements. Thus, field validation concentrates almost exclusively on the design requirements. Design basis may be referred to for the resolution of open items and conflicts between the design requirements and either the physical configuration or the facility documentation.

Field validation is done on DISs rather than on raw design information for the following reasons: the design requirements are fully reconstituted, complete, and accurate; sufficient time has been allowed for reconstituted design requirements to be reflected in the physical configuration and configuration documents; design basis reconstitution represents an extra validation of the design requirements; the DIS is a user-friendly compilation of the design requirements, sorted by system and topic and differentiated by type; and DIS issuance is the final step in overall CM program development. With the issuance of DIS Revision 1, the facility needs to be confident that the DISs are complete and accurate and that the CM program basic relationships are established. From this point on, the CM program focuses primarily on maintaining these relationships.

Field validation does not take the place of initial reconcilement of design requirements, physical configuration, and configuration documentation. As design requirements are reconstituted, they should be released and forwarded through the established change control and document control processes. Open items and discrepancies identified as the reconstituted design requirements are released should be resolved long before field validation. Field validation is the final check that everything is consistent.

Every DIS should have some degree of field validation. The first several should receive full validation, similar to a vertical-slice assessment. Reduced-scope field validations may be acceptable for later DISs if the results of the initial validations are positive. Section 2.5 provides guidance on the performance of vertical-slice assessments and DIS field validation.

3.6.8 MAINTENANCE AND CONTROL OF DESIGN INFORMATION SUMMARIES

The DR program should establish the DIS maintenance and control procedures. Once the DISs are complete and the maintenance and control procedures are in place, maintenance and control of the reconstituted design information are integrated into the normal CM program work activities. The design requirements element is responsible for establishment and maintenance of the design requirements and design basis; the document control element, for the control of documents within the CM program. Typically, the design authority would be assigned ownership of the DISs that are to be controlled in accordance with CM document control element. Thus, the design authority would ensure both that the design information is current and accurate and that the DIS is current and accurate.

Maintenance and control are necessary to ensure that the DISs retain their value as a reference tool for facility activities. Document controls applicable to DISs should be comparable to those for the SAR. Supporting information, computer software, and other DIS references should also be appropriately controlled.

Examples of appropriate controls would include publishing notices of page changes, updating the databases at the time of such changes, and incorporating the changes annually into the DISs. (if the number or complexity of outstanding change notices were significant, incorporation into the DISs would be accelerated.) The DISs should be reviewed and reissued (e.g., every 2 to 5 years on a staggered schedule, and more often for highly modified and safety-significant DISs) to ensure that they continue to meet facility needs and do not become obsolete.

Ready availability to users is essential for the DISs. Facilities should consider establishing information systems featuring centralized information control and user access from convenient terminals. The most effective information retrieval systems have the following attributes: convenient locations, simple

identification of information sources, quick and simple retrieval of information, users guides, and training for potential users.

The integration of complete, validated DISs into the normal design control, change control, and document control programs marks the completion of the DR program.

3.7 SPECIFIC APPLICATION OF GRADED APPROACH: DESIGN RECONSTITUTION

The DR adjunct program is the portion of the CM program most amenable to the graded approach. The primary consideration for adjusting implementation is the SSC grade. The following DR program activities may be adjusted in terms of SSC grades: design information searches (i.e., formal review, smart search, and comprehensive search), regeneration of design requirements, preparation of design information summaries, and regeneration of the design basis. The following matrix shows adjustments to implementation based on the SSC grades.

GRADED APPROACH TO DESIGN RECONSTITUTION ACTIVITIES

System Grade	Formal Review	Smart Search	Comprehensive Search	Regeneration of Design Requirements	Preparation of DISs	Regeneration of Design Basis
1	Necessary	Necessary	Necessary	Necessary	Necessary	Necessary
2	Necessary	Necessary	Recommended	Recommended	Recommended	Recommended
3	Necessary	Necessary	Recommended	Optional	Optional	Optional
4	Necessary	Recommended	Optional	Optional	Optional	Optional

Application of this matrix is based on system grade, not on the grade for individual components. The entry "Necessary" for the comprehensive search, for example, means that all design information and design requirements for a system of grade 1, and for the components of that system, would be retrieved during such a search. The numerical values shown in the table for the system grades are illustrative; system grade 1, for example, could encompass safety systems.

This matrix applies to the case in which the system grade is being applied directly to CM program general criteria; no other graded-approach considerations (e.g., facility technical type, remaining facility lifetime) have been applied. With the application of other graded-approach considerations, the implementation level could be adjusted further, and this matrix would then serve as an example of relative priorities. However, the minimum design information regenerated should be that necessary to support the facility accident analysis and TSRs.

The DR program activities related to reconstitution of design requirements (i.e., formal review, smart search, comprehensive search, and requirements regeneration) should be such as to ensure that the desired/remaining facility lifetime equals or exceeds the time involved in those activities. Thus, if the

remaining facility lifetime is 5 years or more, the full design requirements reconstitution should be implemented; if the remaining facility lifetime is less than 5 years, the searches should be reduced. Retrieving and regenerating safety requirements should have top priority. This guideline is warranted because of the fundamental importance of design requirements to facility operations. Design requirements reconstitution will contribute substantially to a better understanding of the important aspects of facility SSCs, and thus will have a positive impact on operating procedures, training programs, and maintenance programs.

Moreover, the activities involved In the development of DISs enable them to remain in use for a period of facility operation equal to or greater than the period estimated for their development. For example, if the desired/remaining facility lifetime is 10 years, an adjusted DR program that can be accomplished In 5 years is appropriate. In adjusted DR program activities, safety SSCs and safety requirements should receive top priority. Additional discussion of approaches and methods to developing adjusted DR program is provided below.

For facilities that are currently operating and expect lo continue operating for a significant period, it would not be appropriate to adjust the general program criteria according to operational status. Operating facilities that have been directed to change their operational status within the near future should consider the impact of the change on their program scope. For example, a facility that will enter standby status in I or 2 years may be able to provide a technical basis for conducting only a smart search for safety systems and refraining from the regeneration of missing design requirements.

For facilities that are in standby status (i.e., not operating but maintaining the ability to operate), DR program planning is appropriate, but further implementation activity should be withheld pending the announcement of plans to resume operations. Facilities in shutdown status (i.e., not operating and not maintaining any ability to resume operations) should forgo DR adjunct activities altogether.

Facilities in the design and construction phases of their life-cycle should take steps to ensure that complete and accurate design requirements, design basis, and as-built drawings are established prior to turnover and operation, so that no design reconstitution will be needed after turnover. Special emphasis should be placed on accelerated completion of DISs. Clearly, the most complete, accurate, and cost-effective approach is to establish the facility design requirements and design basis in the design and construction phase and maintain them throughout the operational phase. Facilities in the major renovation and redesign phase should accelerate DR reconstitution, establishing firm milestones. For example, completing the smart search might be appropriate before returning to the nominal operational phase. For facilities in the deactivation phase, no actions are necessary to reconstitute design requirements or basis.

Where facility importance or other considerations (particularly remaining facility lifetime) call for an adjusted DR program, the following adjustment strategies may be considered:

- Perform only the most important system and topical DISs. If the DR program scope has to be limited, it might be best to complete DISs for the most important systems only.

- Provide the design basis only for safety requirements. For a program of limited scope, emphasis should be placed on the most important design basis. This option call be used in conjunction with the option above.

- Reduce the scope of searches in favor of regeneration. The program might be adjusted to provide for skipping or limiting searches, particularly the comprehensive search, in favor of an aggressive regeneration program. It may be more cost-effective to go ahead with the regeneration without pursuing every possible source of existing design information.

- Limit the technical management review. For a program of adjusted scope, a full technical management review might not be worthwhile. An effort to identify primarily missing design requirements might be appropriate.

- Do not regenerate missing design basis. The effort might be limited to collecting retrieved design basis information -- that is, forgoing the identification or regeneration of missing basis.

- Adopt short-cuts regeneration. It might be appropriate to adjust the level and depth of regeneration efforts.

- Use an index approach for DIS. The use of an index approach rather than a mixed approach might mean savings in time and expense and still be adequate for the remaining lifetime.

- Include essential DIS contents only. At a minimum, the DISs should define the conditions necessary to determine the operability of the facility SSCs.

These strategies may be used alone or in combination depending on the scope of the adjustment. Other strategies may be adopted in response to individual needs and circumstances. The basis for the scope of the DR program should be established in the program plan.